

REMARKS

Referring to the Office Action, the Examiner has objected to the Abstract of the Disclosure for failing to commence on a separate sheet. In reply, the Applicant encloses a replacement Abstract on a separate sheet, as requested. Accordingly, it is submitted that this objection has been fully addressed and overcome.

Claims 1 - 45 are currently pending in this Application. The following amendments to the Claims are presented herein:

- (a) Independent Claim 1 - has been amended to incorporate the subject matter of dependent Claims 4 and 35.

Consequently, previous dependent Claims 4 and 35 have been cancelled.

Further, previous dependent Claims 36 and 39 have been amended to change the claim dependency thereof from previous Claim 35 to Claim 2;

- (b) Dependent Claims 3, 5 - 9 and 43 - 45 - have been cancelled;
- (c) New dependent Claims 46 - 59 - have been added to better and/or further define the Applicant's invention as claimed. Support for these new Claims is found in the Application as originally filed as follows:

Claim 46 - Page 4, lines 21 - 24; Page 4, lines 32 - 34; and Page 9, lines 2 - 24;

Claim 47 - Page 2, lines 29 - 31; Page 4, lines 29 - 32; Page 9, lines 21 - 24; and Page 22, lines 11 - 15;

Claim 48 - Page 4, lines 17 - 24; Page 9, lines 8 - 14; Page 20, lines 8 - 12; and Page 45, line 25 - Page 52, line 6;

Claim 49 - Page 20, lines 19 - 20; Page 47, lines 6 - 12; Page 47, Table 2; and Page 49, Table 3;

Claim 50 - Page 20, lines 9 - 12;

- Claim 51 - Page 20, line 9 - Page 21, line 17;
- Claim 52 - Page 20, lines 22 - 29; Page 45, lines 10 - 14; Page 47, Table 2; and Page 49, Table 3;
- Claim 53 - Page 45, lines 25 - 27; Page 46, Table 1; Page 47, Table 2; and Page 49, Table 3;
- Claim 54 - Page 20, lines 22 - 24; and Page 45, lines 10 - 11;
- Claim 55 - Page 45, line 25 - Page 52, line 6;
- Claim 56 - Page 4, lines 26 - 34; Page 9, lines 16 - 24; and Page 52, lines 8 - 12;
- Claim 57 - Page 4, lines 29 - 32; and Page 9, lines 21 - 24;
- Claim 58 - Page 4, lines 28 - 29; and Page 9, lines 19 - 21;
- Claim 59 - Page 9, lines 19 - 21.

Referring further to the Office Action, the Examiner has rejected previous Claims 1 - 3, 10 - 12 and 16 - 18 under 35 U.S.C. 102(b) as being anticipated by U.S. Publication 2003/0154036 A1 by Gysling et. al.

Further, the Examiner has rejected previous Claims 4 - 9, 13 - 15 and 19 - 45 under 35 U.S.C. 103(a) as being unpatentable over Gysling et. al. (as applied to Claim 1 and 2) in view of U.S. Publication 2002/0185604 A1 by Coates et. al., and further in view of U.S. Patent 5,568,400 to Stark et. al.

It is respectfully submitted that each of these rejections of the Examiner is overcome by the amendments to independent Claim 1 and the remarks that follow.

Applicant's Invention

The Applicant's invention as claimed in amended independent Claim 1 is directed at a method for analyzing a dispersion comprising the following steps:

- (a) collecting a set of original domain data relating to an attribute of the dispersion, wherein the attribute of the dispersion is transmittance of electromagnetic radiation through the dispersion and wherein the set of original domain data is

comprised of a transmittance image representing **distribution of transmittance of electromagnetic radiation through the dispersion over a spatial area**:

- (b) **transforming** the set of original domain data into a transformed set of original domain data, wherein **the transformed set of original domain data is in the frequency domain**; and
- (c) **characterizing** the dispersion using **the transformed set of original domain data**.

Thus, as claimed in amended independent Claim 1, the dispersion is characterized using the transformed set of original domain data, wherein the transformed set of original domain data is in the frequency domain.

Further, the set of original domain data is comprised of a transmittance image representing distribution of transmittance of electromagnetic radiation through the dispersion over a spatial area. The set of original domain data may be transformed into the transformed set of original domain data in any manner such that the transformed set of original domain data is in the frequency domain. Specific examples of the methods that may be utilized are set out in the Application at Page 7, line 8 - Page 8, line 5 and Page 22, line 26 - Page 23, line 3.

Further, as discussed at Page 9, lines 26 - 31, Page 23, lines 5 - 8 and Page 26, line 23 - Page 28, line 10 of the Application, the transformed set of original domain data may be used in any suitable format which facilitates characterizing of the dispersion in the characterizing step. Preferably, however, a frequency domain spectrum is generated from the transformed set of original domain data, wherein the frequency domain spectrum expresses a parameter relating to the attribute of the dispersion as a function of frequency, and the characterizing step is performed using the frequency domain spectrum.

Referring to the Application, Figures 5, 6, 7, 10, 13, 19 - 21 and 36 provide examples of sets of original domain data which are comprised of transmittance images as contemplated in amended independent Claim 1. Figures 3, 9, 12, 15, 17, 25, 37, 38 and 41 - 43 provide examples of transformed sets of original domain data in the frequency domain which are comprised of transformed transmittance images, expressed as frequency domain spectra.

Anticipation (Gysling et. al.) - Claims 1 - 3, 10 - 12 and 16 - 18

As stated, the Examiner has rejected previous independent Claim 1 under 35 U.S.C. 102 as being as being anticipated by Gysling et. al.. In reply, independent Claim 1 has been amended to incorporate the subject matter of previous dependent Claims 4 and 35.

In order to anticipate a claim, the reference must teach each and every element of the claim (U.S. Manual of Patent Examining Procedure “MPEP” §2131).

In this regard, it is noted that neither previous dependent Claim 4 nor previous dependent Claim 35 have been rejected by the Examiner on the basis of anticipation by Gysling et. al.

Thus, it is respectfully submitted that Gysling et. al. does not teach each and every element of amended independent Claim 1, and therefore, amended Claim 1 is not anticipated by Gysling et. al. In particular, Gysling et. al. does not teach or suggest in any manner the claimed attribute of the dispersion being **transmittance of electromagnetic radiation through the dispersion** (previous Claim 4) or wherein the set of original domain data is comprised of a transmittance image representing distribution of transmittance of electromagnetic radiation through the dispersion over a spatial area (previous Claim 35).

Gysling et. al. describes an apparatus and method for measuring parameters of a mixture having solid particles suspended in a fluid and flowing in a pipe (such as a mixture of coal particles and air in a pulverized fuel). The parameters include fluid/particle concentration, fluid/particle mixture volumetric flow and particle size. The apparatus includes a spatial array of unsteady pressure sensors placed at predetermined axial locations disposed axially along the pipe. The pressure sensors provide acoustic pressure signals to a signal processing unit. The acoustic pressure signals are processed in the signal processing unit in order to measure the desired parameter. (Abstract and Paragraphs [0002], [0006], [0007], [0031] and [0036] of Gysling et. al.).

In one embodiment, the pressure sensors provide pressure time-varying signals which are transformed by the signal processing unit using a Fast Fourier Transform (FFT) or

similar algorithm to provide frequency domain signals. The frequency domain signals are used to determine the speed of sound in the mixture, based upon data previously obtained which establishes a relationship between frequency and the speed of sound. The speed of sound in the mixture is then used to determine the air to coal mass ratio in the mixture or the particle size of coal particles, based upon data previously obtained which establishes a relationship between speed of sound and the air to coal mass ratio or the particle size of the coal particles. (Paragraphs [0036] - [0038] etc. of Gysling et. al.).

In other embodiments, the pressure sensors are used to provide pressure signals which are used to determine the “convection velocity” of vortex disturbances within the mixture, which convection velocity is representative of the volumetric flow rate of the mixture through the pipe. (Paragraph[0105], etc. of Gysling et. al.).

Thus, as indicated, Gysling et. al. does not teach, contemplate or suggest using transmittance of electromagnetic radiation through the mixture over a spatial area to provide a set of original domain data comprising a transmittance image, and does not teach, contemplate or suggest the transformation of a transmittance image into the frequency domain in order to characterize the mixture.

Accordingly, it is respectfully submitted that amended independent Claim 1 is not anticipated by Gysling et. al., and further, that the method claimed by the Applicant in amended independent Claim 1 is not described or suggested in any manner whatsoever by Gysling et. al.

In addition, it is respectfully submitted that Gysling et. al. does not describe or suggest in any manner the subject matter of new dependent Claims 46 - 59, all of which depend directly or indirectly from amended independent Claim 1, as follows:

- (a) New dependent Claim 46 provides for the dispersion to be characterized with respect to a specific group of dispersion characterizing variables. Gysling et. al. characterizes the fluid flow within a pipe based upon the speed of sound and/or vertical disturbances (Paragraph [0002] of Gysling et. al.);

- (b) New dependent Claim 47 provides that the dispersion is characterized with respect to a stability of the dispersion. Gysling et. al. does not discuss the stability of the fluid flowing within the pipe;
- (c) New dependent Claims 48 - 55 depend directly or indirectly from new Claim 47 and relate to a first preferred embodiment of the invention in which the dispersion is comprised of crude oil, asphaltene particles and a solvent. Gysling et. al. measures an air/coal mixture flowing within a pipe (Paragraph [0005], [0006] and [0033] of Gysling et. al.);
- (d) New dependent Claims 56 - 59 depend directly or indirectly from new Claim 46 and relate to a second preferred embodiment of the invention in which the dispersion is comprised of an emulsion comprising oil and water. Gysling et. al. measures an air/coal mixture flowing within a pipe (Paragraph [0005], [0006] and [0033] of Gysling et. al.).

Obviousness (Gysling et. al. in view of Coates et. al. and Stark et. al.) - Claims 4 - 9, 13 - 15 and 19 - 45

As indicated above, the Examiner has rejected previous Claims 4 - 9, 13 - 15 and 19 - 45 under 35 U.S.C. 103(a) as being unpatentable over Gysling et. al. (as applied to Claim 1 and 2) in view of U.S. Publication 2002/0185604 A1 by Coates et. al., and further in view of U.S. Patent 5,568,400 to Stark et. al.

As discussed in *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007), the determination of obviousness under 35 U.S.C. 103 is a legal conclusion based on factual evidence. The legal conclusion that a claim is obvious depends upon at least four underlying factual issues, as set forth in *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966): (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art; and (4) evaluation of any relevant secondary considerations.

Therefore, the test for obviousness must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 227 USPQ 543 (Fed. Cir. 1985); *Manual of Patent Examining Procedure* §2143.02. The Examiner must, as one of the inquiries pertinent to any obviousness inquiry under 35 U.S.C. 103 recognize and consider not only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990).

The fact that a reference teaches away from a claimed invention is highly probative that the reference would not have rendered the claimed invention obvious to one of ordinary skill in the art. *Stranco Inc. v. Atlantes Chemical Systems, Inc.*, 15 USPQ2d 1704 (Tex. 1990).

Moreover, the Examiner must avoid hindsight. The fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. *Manual of Patent Examining Procedure* §2143.01

The Federal Circuit stated in *In re Kotzab*, 55 USPQ2d 1313 (Fed. Cir. 2000) that:

“...to establish obviousness based on a combination of elements...there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant...There must be a showing of a suggestion or motivation to modify the teachings of that reference...”

As discussed above, amended independent Claim 1 incorporates the subject matter of previous Claims 4 and 35.

With respect to previous dependent Claim 35, the Examiner specifically cites Coates et. al. as disclosing the subject matter of this Claim and refers to Figure 10 (depicting an “optical emission spectrometer”) and the “CCD Spectrograph” (60) shown therein. However, it is respectfully submitted that the Examiner has misinterpreted this reference in Coates et. al.

Coates et. al. discloses an on-site analyzer for the analysis of lubricating oils and “functional fluids” (Paragraphs [0005] - [0006] of Coates et. al.). The analyzer is comprised of a

Fourier Transform Infrared (FTIR) spectrometer system (24) and a low resolution optical emission spectrometer (OES) assembly (26). As indicated above, the Examiner specifically refers to the OES assembly and its components as being relevant to the Invention as claimed in previous Claim 35.

As described in Paragraphs [0017] and [0066] of Coates et. al., the OES assembly includes a spark emission assembly having electrodes configured to excite the fluid sample to spectroemissive levels to thereby generate radiation characteristic of the constituents of the fluid sample. The OES assembly generates “a second data set” which comprises “an array of pixel values representative of spectral intensities in wavelength increments over a spectral range (i.e., is substantially continuously valued over at least a first predetermined wavelength range, or, for any particular spectrometer, overall of its range).”

In greater detail, referring to Paragraphs [0102] to [0118] of Coates et. al., the OES assembly (26) includes a spectrometer assembly (60) controlled by a computer controller (28). The computer controller controls application of high voltage across electrodes (128, 130) of the spectrometer assembly to thereby generate a spark. The spectrometer assembly receives the light or radiation generated by the electrodes and generates a spectral pattern in response thereto. As summarized in Paragraph [0112] of Coates et. al.:

“In operation, fluid sample 12 is excited by the spark. When the electrons of the atoms of the constituent materials (as well as the fluid sample) contained therein, are driven to higher energy states by the electrical discharge, they are in an unstable state. When the electrons eventually relax to a ground state, photons are emitted. The energy – or wavelength – of these photons is indicative of the particular atom responsible for the emission. Thus, the detection of light at that wavelength is an indication of the presence of that particular atom in the sample. Moreover, the more light emitted under conditions of constant electrical excitation, the more of these particular atoms are present in the sample.”

Furthermore, Paragraph [0114] of Coates et. al. states:

“Raw spectral data from the spectrometers generally takes the form of an array of pixel values representative of wavelengths and associated spectral intensities over a predetermined spectral range. As noted above, each ordered pixel number may have a wavelength associated therewith based on a preexisting calibration equation.”

Accordingly, it is respectfully submitted that Coates et. al. does not teach or suggest using “transmittance of electromagnetic radiation **through** the dispersion **over a spatial area** to provide a set of original domain data comprising **a transmittance image.**” In addition, Coates et. al. does not teach the “**transformance of a transmittance image into the frequency domain** in order to characterize the mixture.”

Finally, the Examiner has not cited Stark et. al. with respect to either independent Claim 1 or previous Claims 4 or 35 (now incorporated into amended Claim 1). Rather, Stark et. al. appears to have been cited by the Examiner primarily for disclosing transformation techniques, and specifically the transformation of original domain data in two dimensions.

Thus, it is respectfully submitted that none of the cited references, being Gysling et. al., Coates et. al. and Stark et. al., disclose or suggest several features of the Applicant’s invention as claimed in amended independent Claim 1.

Specifically, none of the cited references disclose or suggest a method for analyzing a dispersion comprising “collecting a set of original domain data relating to an attribute of the dispersion, wherein the attribute of the dispersion is **transmittance of electromagnetic radiation THROUGH the dispersion**” and “wherein the set of original domain data is comprised of a **TRANSMITTANCE IMAGE representing distribution of transmittance of electromagnetic radiation THROUGH the dispersion OVER A SPATIAL AREA**”, as claimed in amended Claim 1.

Further, none of the cited references disclose or suggest a method for analyzing a dispersion further comprising “**transforming the set of original domain data [as defined above]** into a transformed set of original domain data, wherein **the transformed set of original domain data is in the frequency domain**” and “**characterizing the dispersion using the transformed set of original domain data**”, as claimed in amended Claim 1.

As several of the features claimed in amended Claim 1 are not disclosed by any of the references, it necessarily follows that there can be no motivation, suggestion or teaching of the desirability of making the specific combination as claimed by the Applicant.

Further, Gysling et. al. provides an apparatus including a spatial array of unsteady pressure sensors providing acoustic pressure signals which are processed to measure a specified parameter of fluid flowing through a pipe. Gysling et. al. relates solely to a method and apparatus wherein the attribute of the dispersion is pressure.

Gysling et. al. does not provide any suggestion, motivation or teaching regarding the modification of the “spatial array of unsteady pressure sensors” such that the apparatus and method would be suitable for use in circumstances wherein the attribute of the dispersion is **“transmittance of electromagnetic radiation through the dispersion”** or the production of a **“transmittance image representing distribution of transmittance of electromagnetic radiation through the dispersion over a spatial area.”** In fact, any such modification would require a completely different or alternate apparatus and method than that disclosed by Gysling et. al.

Furthermore, Coates et. al. discloses an apparatus including a spark emission assembly having electrodes configured to excite the fluid sample to spectroemissive levels, such that when the electrons relax to a ground state, photons are emitted by the fluid sample. The wavelengths of the photons are indicative of the presence of a particular atom in the fluid. Thus, the data from the apparatus takes the form of an array of pixel values representative of the wavelengths of the photons.

Coates et. al. does not provide any suggestion, motivation or teaching regarding the modification of the spectrometer, and particularly the “spark emission assembly,” such that the apparatus and method would be suitable for “collecting a set of original domain data” relating to the **“transmittance of electromagnetic radiation through the dispersion”** or “wherein the set of original domain data is comprised of “a **transmittance image representing distribution of transmittance of electromagnetic radiation through the dispersion over a spatial area.”** Once again, it is submitted that any such modification would require a completely different or alternate apparatus and method than that disclosed by Coates et. al.

As a result, it is respectfully submitted that it would not have been obvious to combine the references in the manner set forth by the Examiner in order to provide the Applicant's Invention, as claimed in amended independent Claim 1.

Summary -

Thus, in summary, it is respectfully submitted that none of Gysling et. al., Coates et. al., and Stark et. al., alone or in combination, teach, disclose or suggest the method as claimed in amended independent Claim 1. Therefore, it is respectfully submitted that independent Claim 1 is allowable and allowance of this Claim is respectfully requested.

Further, dependent Claims 2, 10 - 34, 36 - 42 and 46 - 59 depend directly or indirectly from amended independent Claim 1. Thus, it is respectfully submitted that these dependent Claims are allowable for the distinctions defined therein as well as for the reasons supporting the allowability of Claim 1. Accordingly, allowance of these dependent Claims is also respectfully requested.

In view of the foregoing amendments and remarks, it is submitted that this Application is in condition for allowance and allowance is respectfully requested.

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